Practical Work Portal

Report Year 2023

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Employment at Fletcher Building - Nx2

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Report Submitted : 2023-08-20 PASSED

Assigned Marks : 24 / 25 (Grade : A)

Marker : [redacted]

Hours Verified : 800

Student : [redacted]

Specialisation : Civil Engineering

Student Group : [redacted]

Uploaded Report

[redacted]

Scoring Rubric

Section One	**Passed Section** If you pass Section One you still need to pass Section Two.			**Failed Section** If you fail Section One you will be asked to resubmit the report.			5/5
Section Two	**Passed Section** If you pass Section Two you will still need to pass Section Three			**Failed Section** If you fail Section Two you will be asked to revise and resubmit the report.			5/5
Section Three Part A : Structure of the Report	**Excellent**	Above Average	Satisfactory	Room for Improvement	Below Average	No Marks	5/5
Section Three Part B : Quality of the Report	**Excellent**	Above Average	Satisfactory	Room for Improvement	Below Average	No Marks	5/5
Section Three Part C : Presentation of the Report.	Excellent	**Above Average**	Satisfactory	Room for Improvement	Below Average	No Marks	4/5

Existing Admin Verified hours

No additional time added.

Administrator Add Verified Hours

Administrator Details

[redacted]

Verified Hours | Hours Type

20/08/23 Practical Work Report

[redacted]

[redacted]

Summary

From November 2019 up to January 2023 I worked as a Site Engineer for Fletcher Infrastructure on Puhoi to Warkworth.

In this role I was responsible for significant works throughout large sections of the motorway. I was forced to learn on my feet and apply the skills I learnt at university. My work on NX2 involved me in a wide range of tasks, each with their own lessons to teach. My four years of experience vastly increased my knowledge of the project cycle, contract administration, subcontractor and general management,

Note: At time of writing, full handover has not been achieved. As a result, specific details are limited as part of non-disclosure agreements.

I would like to personally acknowledge the tutelage, support, and trust I received from [redacted], [redacted], and [redacted].

The successful outcomes I was able to achieve in my role were made possible in no small way by the on-ground support of [redacted], [redacted], [redacted] and [redacted].

I had the privilege of working with many inspiring people from all walks of life. My thanks to [redacted], [redacted], [redacted], and [redacted].

Finally, for their camaraderie and 'academic counselling' over a beer at the Puhoi Pub, I thank [redacted], [redacted] and [redacted].

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Introduction

Earlier this year, my grandfather passed away at 92. He spent his childhood in a depression era state house, the son of a 'roadie', armed with a shovel and responsible for maintaining a small section of the forgotten highway. For 4 years, I was blessed to have the same opportunity, working to deliver P2Wk. In many ways, little has changed, but in others everything has.

My grandfather himself walked over the harbour bridge before it opened. For many of our lives, the harbour bridge has been synonymous with Auckland's skyline. In just 6 months, it is already hard to imagine not driving on the new P2Wk motorway.

The scale of what is achievable, and the tools we use to deliver generation defining infrastructure has changed significantly over time. But the world still runs on roads. At some fundamental level, moving dirt from A to B will always be required. Keeping the water out will always be required.

And so long as that is the case, site engineers will be required, to make sure people know what they need to do, know how to do it, and are paid for what they do. This report explains just some of the diverse range of tasks for a role which can be anything from a foreman to a project director, to an engineering designer, to a surveyor, to a labourer or machine operator.

Company information

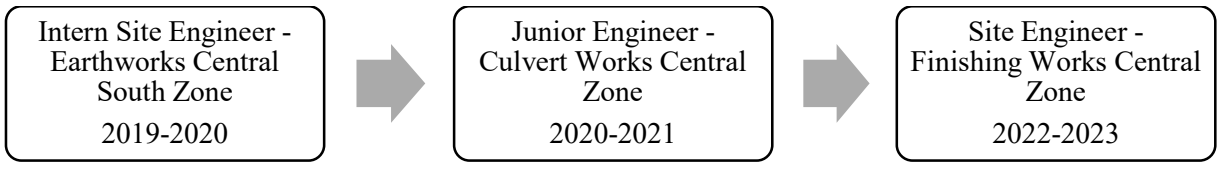
Puhoi to Warkworth spans 18.5km, from the existing Johnstone Hill Tunnels through to Goatley Road. The project is being constructed under a public private partnership structure.

During my internship, I was employed by Fletcher Infrastructure (since renamed to Major Projects), which is the Fletcher Group subsidiary responsible for large scale developments, most significantly major roading projects including P2Wk, PP2O and the Waikato Expressway. Fletcher Infrastructure formed half of the construction joint venture for this project together with the Spanish company Acciona.

For my whole employment, I was based on the project site in Warkworth. The project has a main office as well as several smaller site offices at several of the 21 site access points (SAPs) throughout the alignment.

Initially these SAPs were very distinct, as the existing SH1 (parallel to the new alignment) was used to move between sites. At this stage the significant work on the project was ground improvements, culvert installation and earthworks. By contrast, when I departed the project in early 2022, only 3 offices remained, and access between these was via the main road alignment. This significantly increased collaboration and communication between workers.

Throughout my 3 years working intermittently I rotated through several roles and project teams, as summarised below:



To ensure relevance and succinctness of this report, only my most significant work as a site engineer in the Central North zone is detailed.

Work Experience

My initial work within the central north came as a part of my work achieving final closeout of several culverts and associated stream diversions. From 2020 until late 2021 I was involved in coordination and planning of both contract finishing works, and subcontracted snag works. This included the preparation and pour of concrete aprons, installation of various fish passage devices, remediation of low-flow stream systems, and integration of manholes, grates, debris screens and stepladders.

On NX2, culverts varied significantly in both size, length and design philosophy. There were many permanent streams which were piped under the main alignment, representing significant work. However, there were also intermittent streams, and culverts which acted as an extension of the existing stormwater treatment system.

My role in culvert closeout typically began with a package review of historic documentation, through which I was able to identify issues which had not been signed-off and closed out. Once gaining an understanding of the issue, the remedial approach was determined.

Less technical work which was well understood could either be assigned to the original contractor (based on liability) or handed over to a separate snag work crew. It should be noted that some culverts were initially laid as many as 4 years before finishing work took place, further complicating this process. In either case, I was responsible for resourcing, planning, material procurement, health and safety planning and approval, quality assurance and approval.

For more significant works, technical approaches were often required. This included working with the designers to achieve signoff of the ‘as-built’ assets, or work with third party consultants in order to independently certify or plan remedial works critical assets.

Following this, in early 2022, upon completion of all planned finishing works, my work transitioned into general snag work, focussed on preparation of the alignment for final OGPA sealing, line painting, and barrier installation.

Most critically, barrier deflection zones (i.e. the distance between the wire rope barrier and fill or swale hinge point) were specified to be a minimum of 1050mm to achieve final completion.

This “final tidy up” before handover quickly became both my largest challenge, and biggest opportunity. With a few weeks of planning, including preparation of health and safety documentation, cost estimates and construction methodologies based on observations and lessons learnt elsewhere on the project, I oversaw a much larger and more permanent team. Two “rubber duck”, 14tn Hyundai Excavators on wheels, arrived from transmission gully, along with new operators. 6wheeler trucks were lined up, as well as permanent labour resource, plate compactors, and material stockpiles of aggregate and concrete.

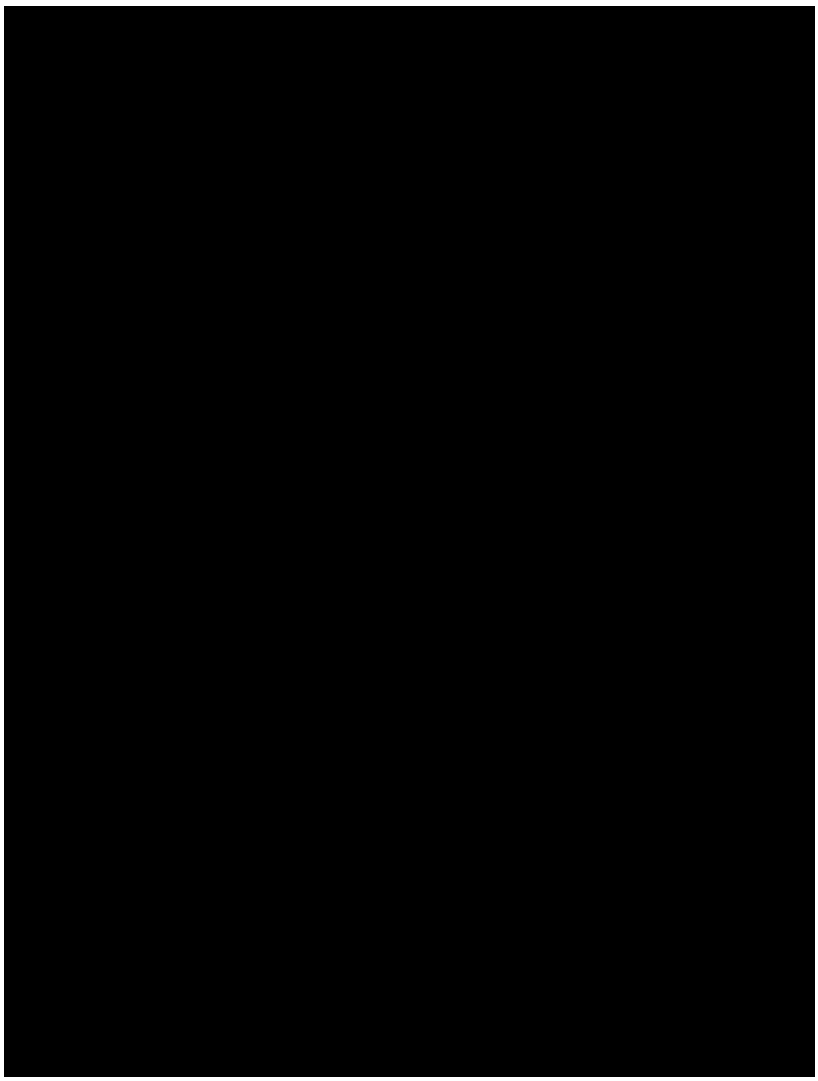


Figure 1. Finished and functional grass drain

'Verge Work' as it came to be known, was slow and tedious, reliant on precision operation and fine tolerances to strike a balance between a steepened embankment and the 1050mm minimum width. In several sections, entire roadside swales, up to 1m deep x 2m wide had to be removed and replaced less than a foot in either direction. After working with the operators, we developed a clear methodology, utilising machine control survey to identify areas where the verge needed widening. In the rugged, off grid central north, this was more challenging than may be expected. GPS was notoriously unreliable, and manual checks were required time and again, including by qualified surveyors using laser-based systems rather than the GPS based machine control.

Armed with a shear-vane, GPS, and tape measure (for when things just didn't quite look right) I walked the beat, spraying out areas for re-do by machine. Supervision of my other crews meant I was often on ground, and this helped ensure good outcomes. Early identification of damage to permanent works was key, and one of my key responsibilities was to correct methodologies and explain the score to new operators (particularly truck drivers).

It was during these hours on the ground, that I developed an understanding of how designs needed to be executed to succeed. This expertise was easily applied, with many hectares of work done over years meaning the construction of a drain on one side of the road may not match that on the other. Working out a consistent way to execute the pinning of grassroots, or to achieve interlock of rip-rap

was a trial and error process. Hand labour was often required to achieve fall on drains where the tolerance had been ‘used up’ through changes to the heights of other key reference planes.

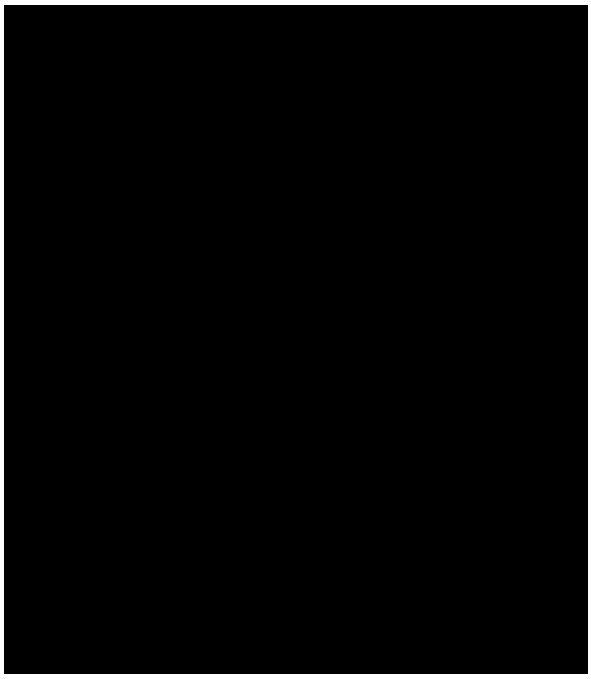


Figure 2. Gabion Rock in a Scour Zone

Aside from the machine work, minor snags seemed to crop up daily, the majority requiring only 2-3 hours of work while being highly technical. This quickly became a significant time-sink for me, as my labour crew would often have to drive to an area, have the job explained, set up, complete work, pack down, and move on multiple times throughout any given day. Luckily for me, the soft-start to excavator work allowed me to build trust in the operators, and work with them to develop methodologies and decentralise command. For me, this often meant receiving daily updates at pre-start from my crew, while going days without any issues cropping up. I consider myself extremely lucky to be able to have worked with skilled, motivated, and independent operators throughout this project. In late February of 2022, the addition of a permanent foreman to the Verge Work and snag team further enabled me to step back and divert my attention elsewhere.

Figure 4. Concrete Swale Solution (somehow compliant with design requirements)

Word of a successful crew, or methodology, often travels quickly on a project, especially one as interconnected as the NX2 of early 2022. As a result, I had the opportunity to work on the projects Southern Connection to complete critical path works ahead of the first stage of traffic livening. This work was highly rewarding, involving long hours on beautiful summer days as the inevitable 'final scramble' began. Health and safety was a large focus, but the communal feeling created by the tight deadline meant no one was above a tap on the shoulder and a nudge in the right direction.

Works in the south continued over the ensuing weeks, and gradually staff were reassigned. My last day in the southern connection was 2 weeks after starting. And thus, we arrive at the first of many ill-fated wet days throughout 2022. March 21st. NX2 was equipped with many industry leading technologies, with remote rain gauges amongst their ranks. The thundering rain that woke many Aucklanders on that Monday morning was measured to be the wettest on record for Moir Hill, a 1 in 250-year intensity of over 70mm/hr. It is worth noting at this point, the unique geography of Moir Hill (the location of the project offices in which I was focussed). As the highest point in at least 10km in either direction, and with a relatively unobstructed valley facing towards the sea, many clouds chose to 'shed some weight' for their upwards journey as they approached either northward or southward. On most days it was damp, foggy, and rainy.

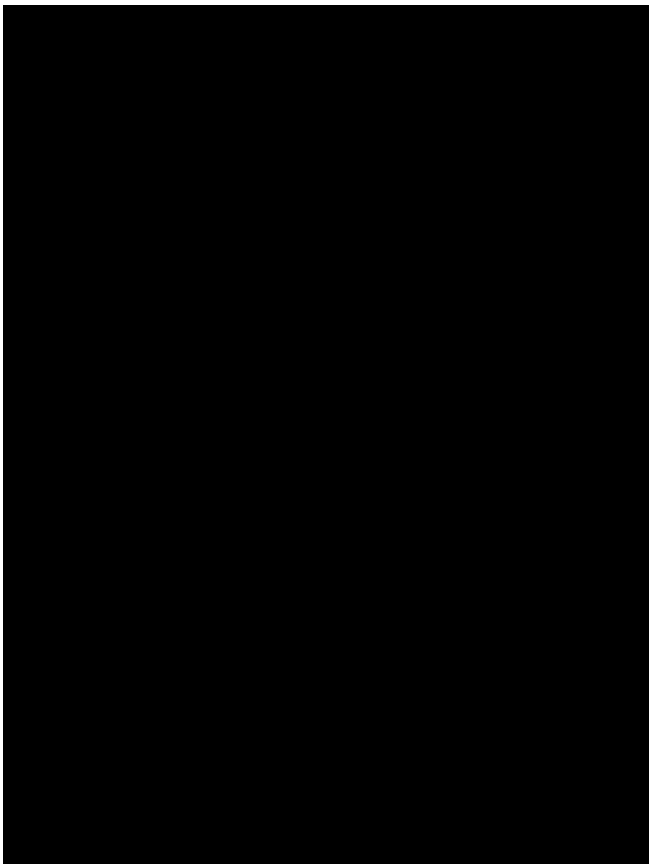


Figure 3. Damaged drain from March 21st. These rocks weigh several kilograms each.

It needs no explanation that applying record breaking intense rain onto exposed, or recently topsoiled and seeded (or hydroseeded) surfaces causes record breaking damage. At this point, work on the project changed. What had been purely a physical battle became a test of spirit.

Initially, repairs were undertaken simply to restore. That lasted a month. Once winter began in earnest, and the accompanying rain washed away another month's progress, rebuilding needed a fresh approach. It was here that I was able to apply engineering judgement to real world situations. Cheeky "off the books" solutions (a targeted bag of cement, or use of a lawn roller), new turf reinforcement, upgrades of drain sizes, shotcrete capping to replace grass lined swales, and gabion armouring in scour zones on the edges of rock cuts were some of the many solutions I was able to research (formally or not), price up, order, and install. Throughout 2023 winter, works became more modularized and as the winter workforce slimming took place, slower. This allowed more time to plan snag works, and thus secure more innovative solutions.

The extra time also enabled more dialogue with construction phase support (CPS) engineering. Dialogue with Beca and Tonkin Taylor engineers helped develop my skills further, as I was able to understand their concerns and what they would be looking for. My experience in the southern connection was also valuable in this regard, as witnessing final inspection with the independent reviewer gave a clear understanding of which checks the finished product needed to satisfy.

Finally (and as an excuse to show the photos), it is worth discussing the Mahurangi Road Slip (fig 5). In typical fashion, the largest landslip I've seen was what greeted me on an otherwise boring Friday morning. Even more typically, this was 8 hours before a project function. Bummer. Even more typical, this road had already been handed back over to the forestry company, and they needed access from the next Monday or damages would be charged to the project. Even more typically, our foreman, project engineer, and more senior site engineer were on holiday. So it was that it fell on me to supervise the initial phase of the clean-up.

Fig 5. Mahurangi Forestry Road Slip

Because of the location of this landslide, it was not possible to use larger dump trucks. Disposal was long run, on the state highway Work was slow, and frequently had to stop to scrape off the chipseal to stop the less powerful 6-wheeler trucks slipping. The road itself is designed for logging trucks and is thin with a significant drop on each side. The setup of bunds and a turning bay further constrained an already tight site, meaning there was only room for 2x 25tn excavators.

During the initial weekend, I supervised removal of approximately 3000m3 in 6 wheelers. For reference, one 6 wheeler is able to carry approximately 5m3 of earth. On a 60-minute turnaround, and loading a truck every 4 minutes, 15 trucks were required on run.

The cause of this slip was a combination of forestry slash and a forgotten pipe. A true illustrator of the butterfly effect, and something that gives pause for reflection. Had this landslide occurred during the day, it could easily have resulted in a fatality.

Reflective Appraisal

The ability to manage significant projects independently within a site engineer capacity was eye opening.

I was able to single-handedly drive initiatives that involved hundreds of thousands of dollars of expenditure, from ideation to technical review and discussion, to proposal, to execution.

On this project, I learnt so much more than what can be written on a page. Every day was a new lesson. [redacted].

[redacted]

Major attention was drawn to removing the stigma around metal health issues faced by those in construction, and working a role in this space helped me realise the extreme level of stress and pressure that was applied by the environment be it physically, mentally and professional.

Working in construction, in particular a significant project nearby to my home that will no doubt serve the community for generations, was incredibly rewarding. There was rarely a day when I didn't wake up (at 5:00am) looking forward to work. Many people outside of infrastructure fail to recognise the significance of major infrastructure projects, and the scale of investment, both temporal and fiscal, that is required to enable seamless everyday life.

The road which I helped deliver will save a few minutes for 35,000 vehicles a day. A total of over 50 days, every day. [redacted] Over its 100-year life, it will save 5,000 years of people's lives. Because the benefits (and the costs) of these projects are typically distributed over so many people, in such small quantities, we fail to respect them.

[redacted]

[redacted]

I hope everyone can achieve something like what we were able to achieve in P2Wk. Perhaps it is the pride before the fall, but I look forward to my next challenge. Bring it on!

Conclusion

To conclude, I worked on a wide range of different projects and tasks in the service of completing the larger motorway. With over 4-million man-hours spent on the project, my efforts pale in comparison to those of others, but the project illustrates more than anything the value of what can be achieved by collaboration between hundreds of people.

A project of this scale is always driven by those who step up and shoulder responsibility, it is simply too large to administer every detail. The most major slip I worked on was caused by someone simply forgetting to remove a pipe. Likewise, many of the issues I spent months fixing were not the result of malice, or even negligence, but simply the extreme scale of the project.

The final motorway has been battle tested, but so have my engineering and professional skills. Working in this role enabled my development and placed me in pole position for the remainder of my career, wherever that will take me.

I am extremely grateful to have had the opportunity to shape New Zealand's future in some small way.